Unit 17 Denmore Industrial Estate, Denmore Road, Bridge of Don, Aberdeen AB23 8JW

# User Manual
# Modular BOP System

**This Manual Covers the Following Part Numbers:**

**193-3653-HV0**

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## Revision History

| Issue, Release Date | Description |
|---|---|
| Rev A, 03 Mar 11 | Initial Issue |
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## Safety

**WARNING: Trapped air requires considerable time to compress and when it is compressed is highly dangerous. It has enough stored energy to separate parts with considerable force.**

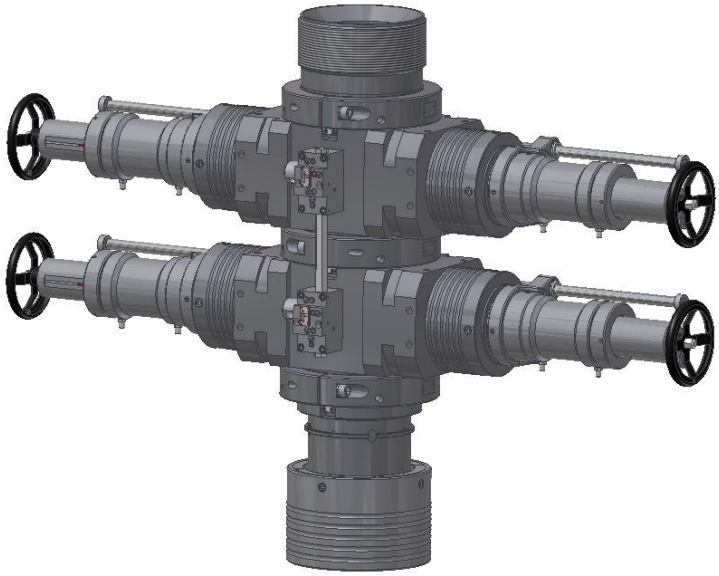
This product contains high pressures, when in operation. Failure of any part may cause injury. Welding, corrosion, rough handling, or other abuse may affect the Integrity of this product.

All pressure equipment has a particular pressure rating and care must be taken to ensure that no item is used in a situation that may cause its working pressure to be exceeded.

All personnel involved in pressure testing must be formally trained, competent and utilise the appropriate PPE.

Ensure the identification plate is fitted and is displaying the correct information

This equipment and the equipment it is attached to is heavy never position yourself below a suspended load



# 1 Introduction

## 1.1 General

The Modular Blow out Preventer (BOP) provides essential safety barriers against well pressure during wireline operations. It is located directly above the wellhead flange. The BOP has two or more sets of wireline rams for sealing against slick line and then sealing against the well pressure.

The ram consists of a hydraulic piston that can be extended or retracted to energise or retract the ram. The ram has a set of inner and horse shoe seals that when compressed against the opposite ram forms a continuous seal that is further energised by the application of pressure in one direction. The ram consequently can be arranged so that it holds pressure from below the BOP or from above.

Across the rams there is an equalisation valve assembly. This is used to equalise pressure across the rams so that the rams can be withdrawn to open up the well bore. The equalisation valve assembly consists of a cone seal set on a screw. Unwinding the screw opens the valve and allows equalisation across the rams. Tightening the screw closes the seal and prevents pressure from passing through the valve assembly. There is also a circuit to allow the injection of chemicals into the well or across the equalisation valves, and can be used to prevent the valves freezing while bleeding down gas (injecting glycol for example).

Between each of the ram pairs it is possible to inject grease through the injection port. For braided line operations or in cases where an effective seal cannot be achieved, the injection port can be used to inject grease at pressures greater than the well head pressure. The injection port has a check valve to prevent well pressure entering the injection system.

The BOP is mounted to a crash frame assembly that provides forklift pockets protection during transport. The crash frame has foldable platforms for the operators to stand on when operating the BOP and stabbing in the lubricator (not shown in diagrams below).

This user manual serves as an introduction to the equipment and contains the relevant specifications, operation, planning and maintenance instructions, parts list and drawings.

## 1.2 Product Identification

Phuel products are identified by a unique serial number that facilitates full product traceability. Each product is supplied with a documentation pack that

contains product certification and material/inspection reports. The serial number is always etched on the surface of the product but can sometimes be difficult to find or read after painting. A customer identification number is also included to allow the customer to track the asset in their system.

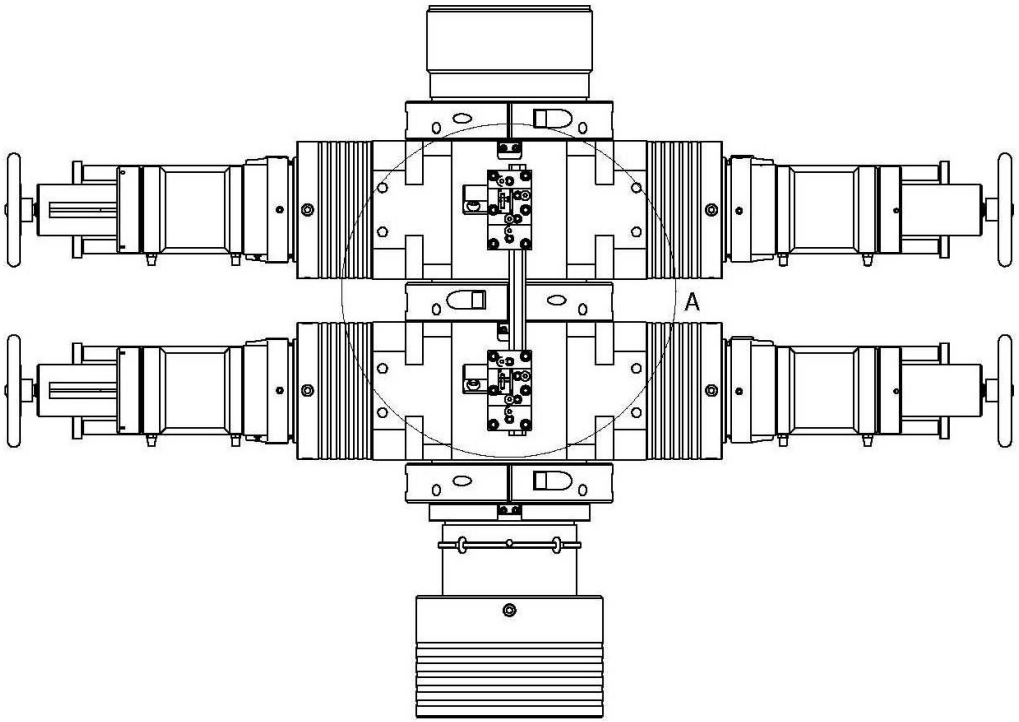
A stainless steel band secures the nameplate tag that is stamped with the information shown below. This tag should be located in the first instance to ensure that this manual refers to the correct equipment.

PHUEL OIL TOOLS LTD
DESCRIPTION & SIZE
CUSTOMER ID No
PHUEL ID No *YY-XXX-XX*
MWP & SERVICE
TEST DATE

## 2 Technical Specification

| | |
|---|---|
| Top Connection | 11.5-4 ACME Quick Union Box |
| Bottom Connection | 11.5-4 ACME Quick Union Pin/ Collar |
| Height | 49.55”/ 1.26 m |
| Width | 70.9”/1.80 m |
| Working Pressure | 10,000 PSI (690 Bar) |
| Test Pressure | 15,000 PSI (1034 Bar) |
| Service | $H_2S$ |
| Hydraulic Pressure | 3,000 psi (200 Bar) Max (Standard Actuators) |
| Stroke Volume (Standard Act) | 52 cu-in to close – 48 cu-in to open – Total =107 cu-in (1.64 litres) |
| Stroke Volume (Shear Act) | 52 cu-in to close – 48 cu-in to open – Total =107 cu-in (1.64 litres) |
| Weight | 2448 lbs / 1110 kg |
| Hydraulic Connections | Wireline Rams - 3/8” Phoenix Beattie HP Quick Release Coupling (QR74 Range) |
| | |
| | Actuators – ¼” NPT x 3/8” Tube |
| | Grease Injection – 3/8” Phoenix Beattie HP Quick Release Coupling (QR74 Range) |
| | Chemical Injection Port – 3/8” Phoenix Beattie HP Quick Release Coupling (QR74 Range) |
| | Gauge Port – ½” NPT (10,000 psi max WP) |

**Table 1: Technical Data**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# 3 Technical Description

## 3.1 Basic Description

The Phuel BOP provides a positive barrier against well pressure while performing intervention operations. The equipment consists of three sets of hydraulically operated rams that can be individually pumped closed to form a seal against pressure. The orientation of the ram outer seal determines whether the rams hold pressure from above or below. By opposing adjacent ram sets it is possible to apply pressure between the rams through a grease injection port, normally at a pressure greater than the well pressure, and thus form a positive protection barrier. This technique is particularly effective when sealing against braided wire-line as a leak tight seal cannot be obtained due to the construction of the wire. The high viscosity of the grease allows the pressure to be maintained even though a small leak (of grease) still exists.

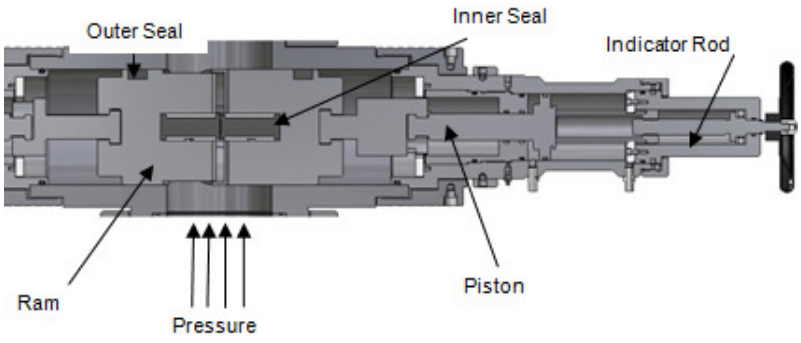



**Figure 1: Section through BOP rams (closed position)**

The rams are driven by a hydraulic actuator, which consists of a piston with an indicator rod to provide visual confirmation of the position of the rams. A manual locking mechanism is also provided to ensure that when the BOP is closed hydraulically during operations it cannot be opened again until the mechanism is deliberately withdrawn. Each of the actuators assemblies are identical on the Phuel BOP and so can be positioned in any ram bore. This provides excellent flexibility for maintenance and redress of the equipment.

# 4 Operation

## 4.1 Operating the Rams

Note – Always ensure that the pressure across the rams has been equalised before opening.

### 4.1.1 Hydraulic Operation

The BOP has been provided with flexible armoured piping to offer the required fire protection level. Two connections are required for each ram set for open and close. It is important that both connections are connected, as the fluid displaced by the movement of the piston must be allowed to pass through the valve system back to the reservoir

A Well Control Unit (WCU) is normally used to operate the BOP in an offshore environment. Refer to the relevant manual for that equipment for details of operation and connection. An alternative pump pack may be used for onshore maintenance work but the operation of this equipment is out with the scope of this manual. **IT IS IMPERATIVE THAT BOTH THE RAMS ARE CLOSED SIMULTANEOUSLY WHEN CLOSING AROUND THE WIRE.** Failure to follow this procedure may result in cutting or damage to the wire.

### 4.1.2 Manual Operation

The rams can be closed manually (but not opened again) by turning the hand wheel in a clockwise direction some 30-40 turns providing that the hydraulic fluid from the other side (open port) is allowed to escape. The hydraulic connections must still, therefore, be made up to the WCU even when intending to operate the rams manually. When closing around the wire **IT IS IMPERATIVE THAT THE UPPER GUIDED RAM AND THEN THE LOWER GUIDED RAM IS FULLY CLOSED BEFORE CLOSING THE UPPER NON GUIDED RAM AND THEN THE LOWER NON GUIDED RAM.** Failure to follow this procedure may result in cutting or damage to the wire. The non-guided rams can be identified by the restrictor valve block attached to the return hose for the actuator – This side must be closed last.

Once the rams have been closed using the manual method it is not possible to open them again without hydraulic pressure. The Hand wheel, however, must still be turned in an anti-clockwise direction until it stops to allow the piston to move fully back.

### 4.1.3 Locking the Rams

After closing with hydraulic pressure the piston can be mechanically locked by winding in the manual mechanism. Turning the hand wheel in a clockwise direction will advance the locking mechanism by 3mm per turn. It is therefore necessary to turn the hand wheel 30-40 turns to lock in the piston. Continue to

turn until the hand wheel stops, indicating that the piston is now against the back-up lock.

For safety reasons and to reduce the mechanical effort required, **Phuel recommends that the hydraulic pressure be removed or reduced while closing the mechanical back up**. This reduces the risk of injury caused by the failure of a seal under hydraulic pressure and decreases the time required to implement the back up feature.

It is important to remember that the manual lock must be fully withdrawn before the rams can be opened. No damage to the mechanism will occur if pressure is reversed with the lock in place – providing that the maximum operating pressure is not exceeded.

## 4.2 Equalising across the rams

Each ram has a dedicated equalising valve block and these blocks are connected together to allow single point chemical injection, pressure measurement and dump facility.

There are four valves on each block, two are for equalising and two are for isolation. By opening and closing the appropriate valves it is possible to either equalize the pressure across closed rams, inject chemicals above or below any of the rams or a combination of both. There are two isolated external ports that allow the connection of a pressure gauge and drain hose if required.

## 4.3 Job Planning

### 4.3.1 Before the Job

- Check that the certification is within date and that the scheduled maintenance is up to date.
- Examine the BOP Assembly, to make sure that it is good operating order and assembled with the Rams in the correct orientation for the desired operation.
- Functioning of the Rams may be checked, by running both Rams to the closed position. Do not exceed the maximum operating pressure when closing the Rams. Pressure test the rams from the direction of the well (or applied) pressure that is expected during the operation. This also verifies that the rams are in the correct orientation.

### 4.3.2 During the Job

- Special care should be taken that the Rams are fully open when passing any equipment through them. The impact of a collar hitting a Ram may damage the Ram to such an extent that the Ram may no longer Seal, or prevents it from fully opening.
- Only lift the BOP using suitable lift caps. Do not sling or attach lifting equipment to the crash frame to lift the BOP assembly.
- Care should be taken to completely remove any residual pressure or accumulated pressure existing on Lubricator equipment above the BOP, before disconnecting the Lubricator.
- Hydraulic Hose ends should never be allowed to drop in to dirt or grit, or otherwise become contaminated with foreign matter. Any dirt or grit introduced into the BOP is very injurious to the equipment. If end connections become dirty, they should be cleaned thoroughly with solvent and dried.
- Only clean Hydraulic fluid should be used (Shell Tellus 22 is recommended) to operate the BOP. The use of mixed types, dirty, or very old fluid of unknown origin is not recommended. When one of these conditions is known or suspected, the hydraulic system should be flushed and the hydraulic fluid replaced.

### 4.3.3 After the Job

After each job, the BOP should be thoroughly cleaned, repaired as may be required and redressed.

# 5 Maintenance

**All maintenance to be carried out by suitably qualified and competent personnel**

## 5.1 Introduction

Regular maintenance of the equipment using Phuel redress kits or approved spares is essential to its continued safe operation. Ensure that the pre and post job operating procedures are followed and that maintenance records are kept.

## 5.2 Schedule

The maintenance schedule may be governed by international or company standards and the following is considered to be the minimum requirements.

### 5.2.1 Pre & Post Job

Refer to Section 4.3.1 and Section 4.3.3 for details.

### 5.2.2 Yearly

- Disassemble BOP
- Clean and degrease all components.
- Inspect the condition of sealing surfaces and surface coatings, repair/replace as necessary.
- Re-coat threads and sealing surfaces if necessary. Contact Phuel if in doubt.
- Replace all elastomeric seals.
- Re-assemble BOP.
- Pressure Test to 300 psi and to maximum working pressure.
- Inspect paintwork and repair where necessary.

### 5.2.3 Five Yearly

- Yearly maintenance, plus the following.
- Carry out surface NDE on all component threads and damaged surfaces.
- Pressure Test to 300 psi and maximum test pressure per API 6A – PSL3 (Witnessed by certifying authority).

## 5.3 Safety

- This product contains high pressures, when in operation. Failure of any part may cause injury. Welding, corrosion, rough handling, or other abuse may affect the Integrity of this product.
- Many of the components are heavy and should not be lifted without lifting aids.
- Wear appropriate personal protective equipment.

- Do not over exert yourself while using torque wrenches. Use appropriate mechanical advantages when available.
- Ensure that all tools and equipment are in good condition and are suitable for intended use.

## 5.4 Tools

The following tools are required.

- Non marking Memac Chain Wrench.
  Other pipe wrenches may be used but will mark equipment.
- Piston Seal Sub Assembly Tool (Part No. 900-1577-400).
- Allen Key's (7/32, 5/16" & 3/8" long version for removing Actuators from the BOP).
- External Circlip Pliers.
- ¼"-20 UNC Socket Head Cap Screw x 1" Long.
- Pair of Long Nose Pliers.
- Large Flat ended Screwdriver.
- Hide or Rubber Mallet.
- Seal Grease
- Oil spillage-cleaning kits.
- 5K Hydraulic pump and Gauge to operate Actuators.
- Lifting equipment/Aids, as required.

## 5.5 Ram Seal Redress

**Note: If rams are required to be removed ensure they have been pumped forward until only 2" of the indicator rod is visible**

### 5.5.1 Access Rams

This procedure results in the removal of the actuator assembly from the BOP body in order to gain access to the rams.

- Ensure Rams are fully opened.
- Back off the Actuator from the BOP using the extended 3/8" Allen Key in the Cap Screw heads on the Locking Sleeve. Do not loosen the cap screws during this process.
- Once the thread is fully disengaged, pull the Actuator fully back to the End Stops.

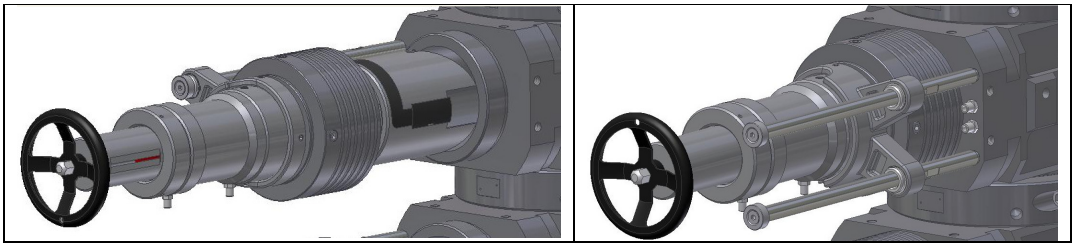


**Figure 2: Accessing the rams**

### 5.5.2 Ram Removal (not required to redress ram seals)

- Remove Ram from Actuator, by sliding the Ram off the Ram Tee.

### 5.5.3 Ram Seal Redress

- The Inner Ram Seals can be removed by simply sliding the seal out to either side
- The Outer Seal can be removed by levering out one end with a suitable instrument and simply pulling off.
- The Ram is now completely stripped down. Clean and inspect all parts for evidence of damage or excessive wear. Check the seals and replace if required. Repair or replace any damaged or worn parts. If the seals are to be redressed use the parts from the specified redress kit.
- Assemble Outer Seals by pushing the tab into the slot in the ram and working it around the radius of the ram. Tap home using a rubber or hide mallet and if required use a screwdriver to lever the second tab over the edge of the slot. Take care not to significantly damage Seal during assembly but expect that some slithers of rubber will be produced as the corners of the rubber seals are removed by the assembly operation. Tap all around the circumference of the seal to ensure that it is bedded into the groove and that the seal is not protruding above the ram diameter.
- Slide the Inner Seals into Ram taking care not to dislodge the outerseal in the process.

**Figure 3: BOP Wireline Rams**

### 5.5.4 Re-attach to BOP Body

- If the rams were removed from the actuator (Section 5.5.2) then slide the ram back onto the Tee taking careful note of the orientation of the rams depending on its intended use for the BOP assembly. (i.e. if pressure is to be held from below then the outer seal must be on top – otherwise it must be on the bottom). Attach a hydraulic pump to the open port of the actuator and pump the rams back into the recess in the actuator ensuring that the ram does not hang up on the actuator front face. When fully back remove the hydraulic pump.

Note - It is still possible to assemble the actuator to the BOP without pumping back the rams but more effort may be required to allow the thread to make up.

- Apply a generous coating of grease to the inner and outer seals.
- Push the Actuator back into BOP Body taking care that the edges of the guide pass into the seal bore and make-up the thread using a 3/8" hex key in the cap head screws to provide the torque. Making up the thread will drive the actuator assembly fully home.
- The Ram Assembly is now fully made up. Repeat this procedure for each ram seal that need to be replaced.

## 5.6 Modular Connection

The Modular BOP allows modules to be separated and re-configured to suit operation needs. Follow this procedure to split and re-make the modules as required.

Note – This must be carried out in a workshop environment with pressure testing facilities by suitably qualified personnel

### 5.6.1 Splitting the Connection

- Locate and remove lock block (equalisation blocks may need to be removed to allow access)
- Remove the bolts that hold the Collar together. There are two design options – one with two bolts on each half and one with a single bolt.
- Split the Bolted collar using a cold chisel if required
- The two assemblies can now be pulled apart
- Inspect the T-Seal and replace if necessary
- Inspect the Pins to make sure they are not damaged. Replace if necessary

### 5.6.2 Re-Making the Connection

Note - Take note of new body serial number to allow update of traceability

- Ensure that the Pins and T-Seals are in good condition
- Lower the upper module down to locate the pins in the holes then push down to engage the seal. Drive down with a weight or blows with a soft face hammer if required. The end faces should be almost flush within 1mm.
- Fit Bolted collars ensuring that the gap between the two halves is completely closed – rotate the collar (tighten) until it bottoms out then back it off to line up the holes for the Lock Block.
- Fit lock block to hold collar in place
- Assemble bolts and washers.
  Two Bolts – Torque to **150Nm large bolt and 100Nm small bolt**
  Single Bolt – Torque to **150Nm**
- Carry out pressure testing to maximum working pressure see Test Procedure below
- Update paperwork with new numbers for traceability

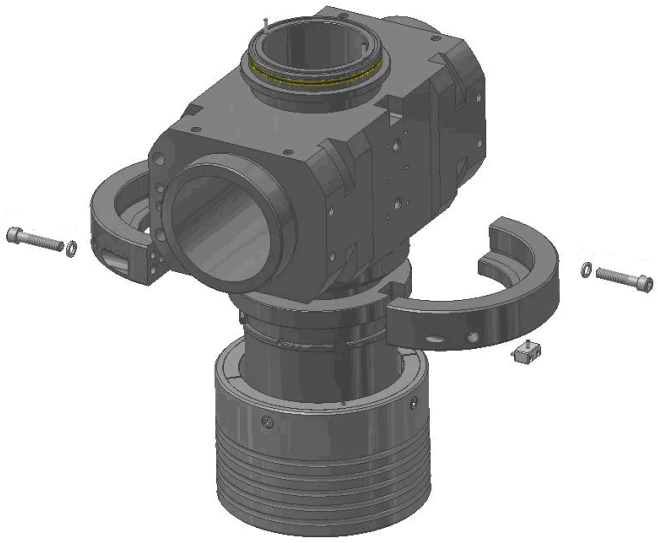
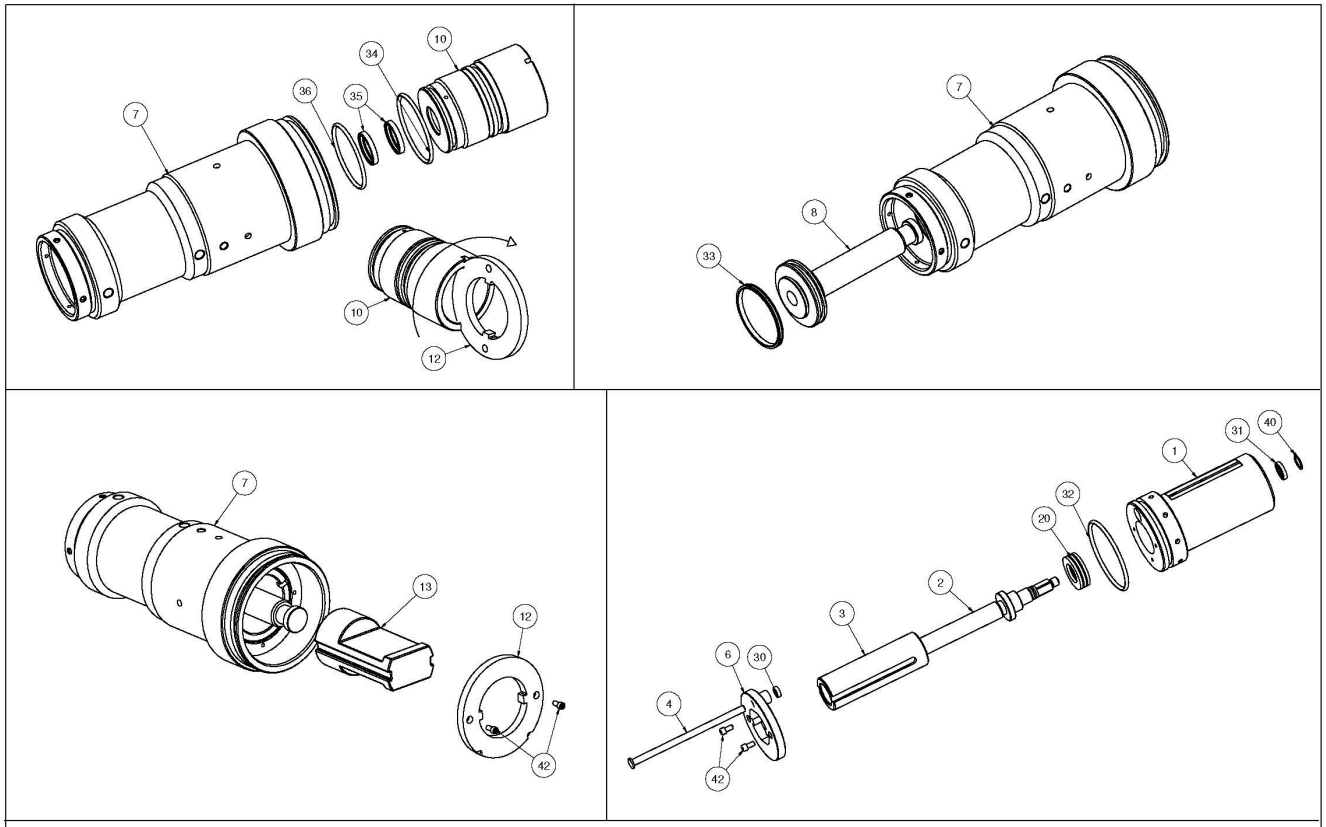
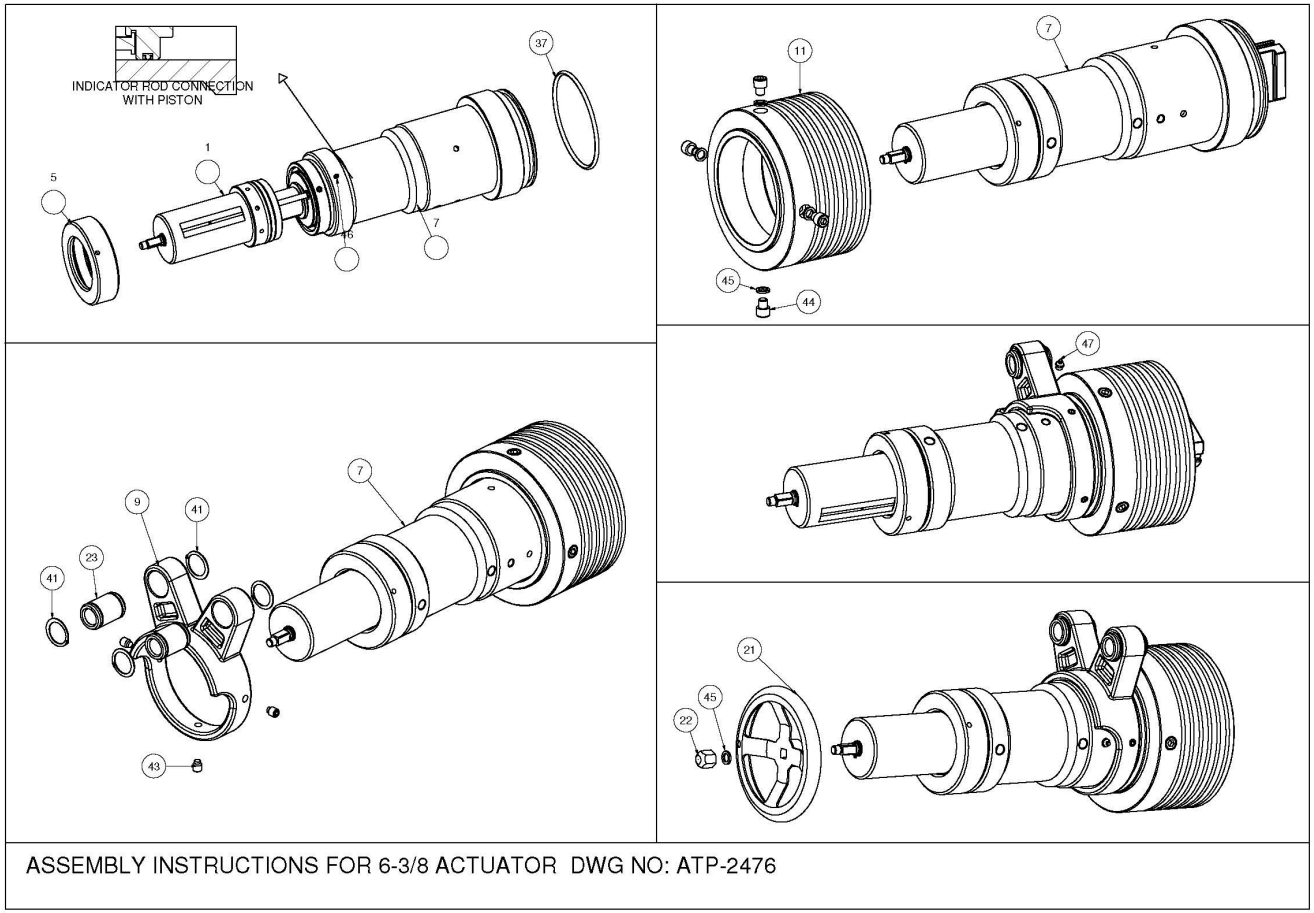


**Figure 4: Example of Single bolted collar and lock block**




ASSEMBLY INSTRUCTIONS FOR 6-3/8 ACTUATOR DWG NO: ATP-2476

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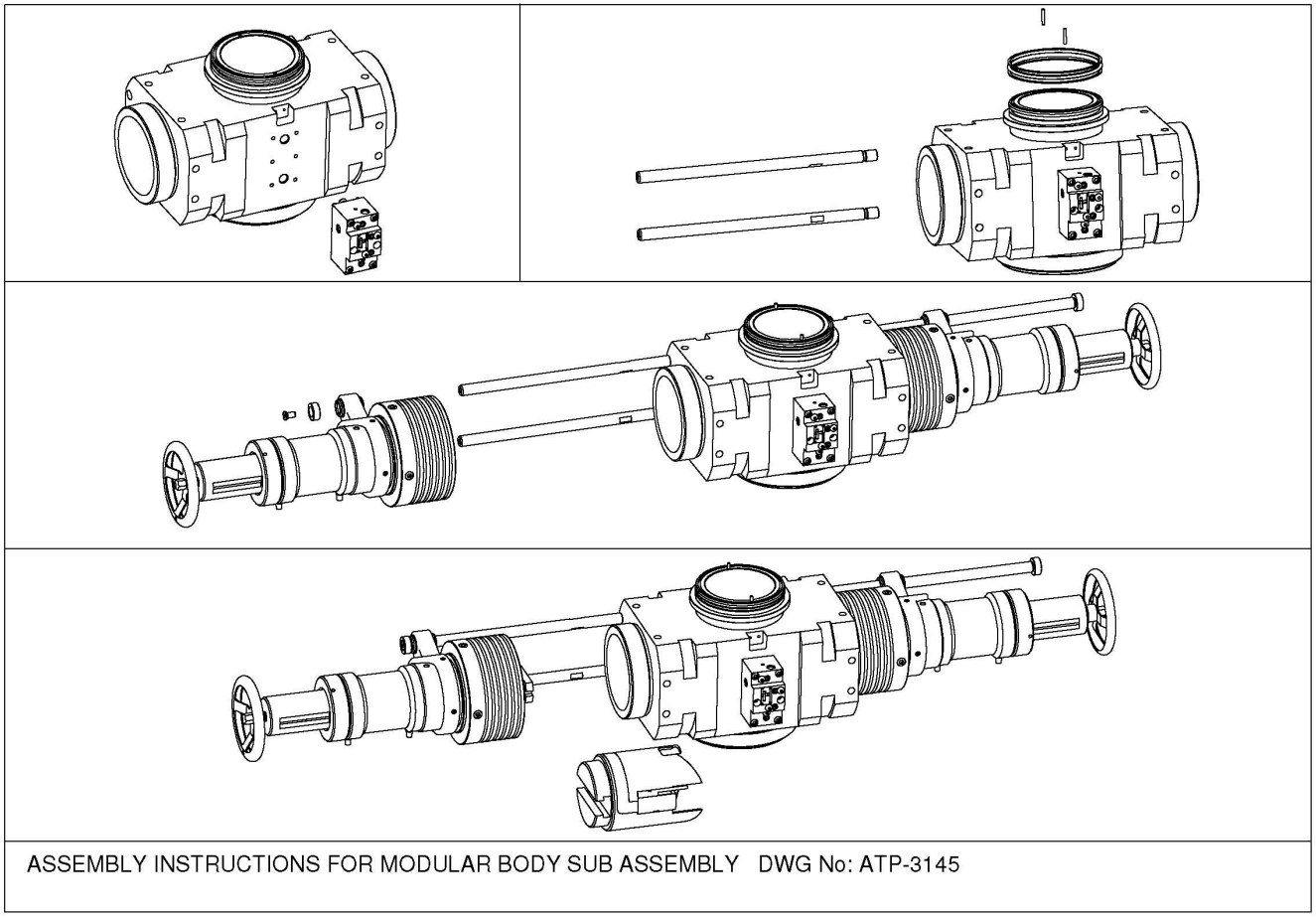
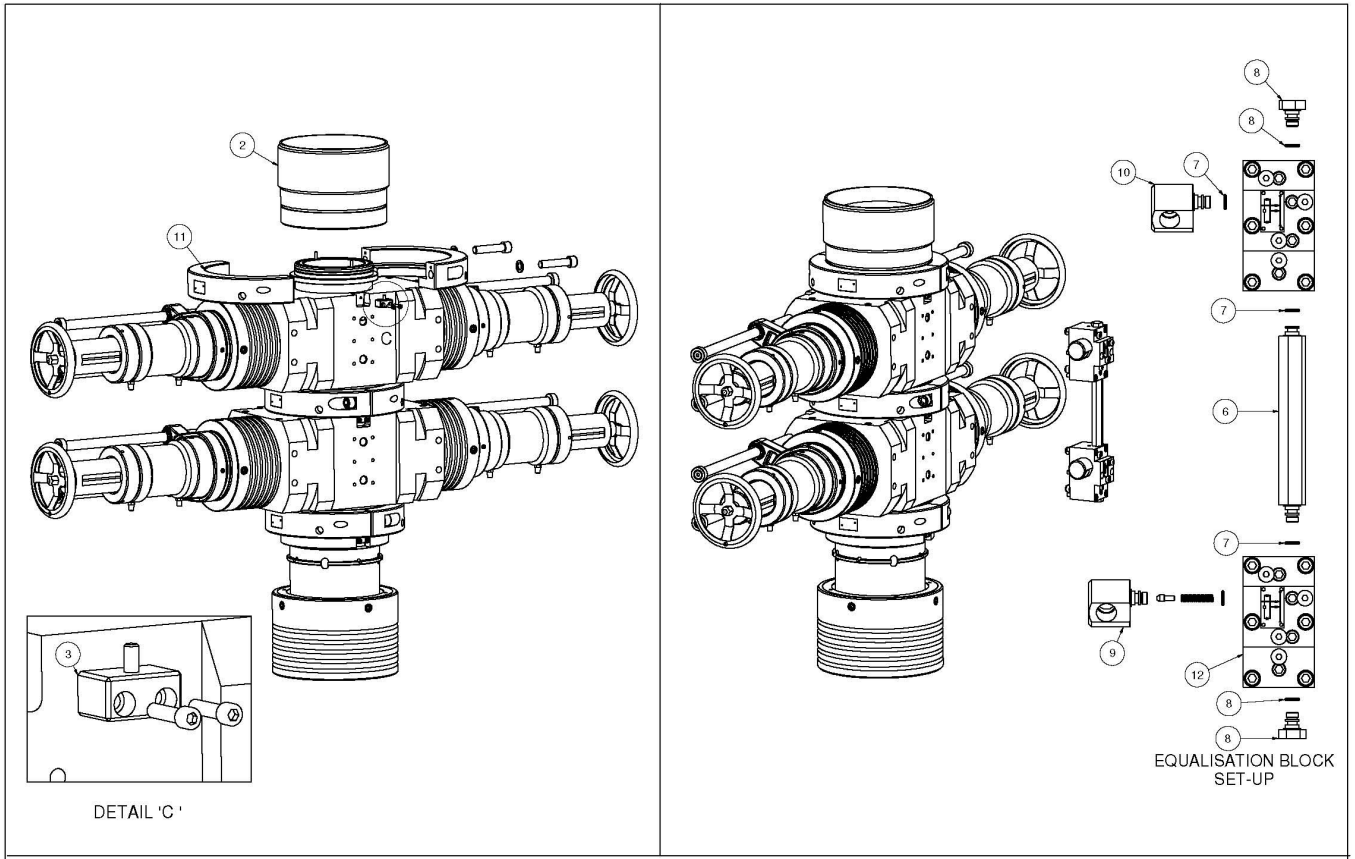
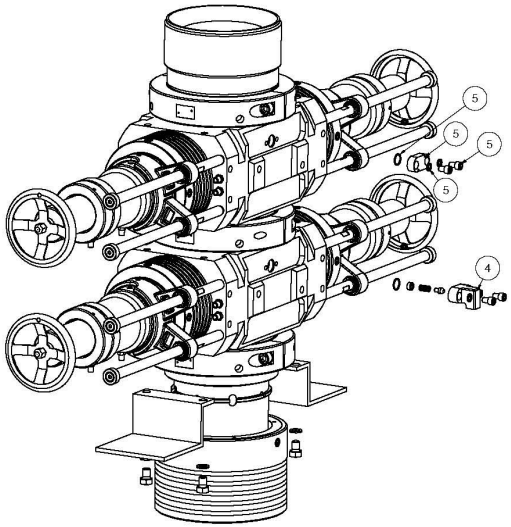
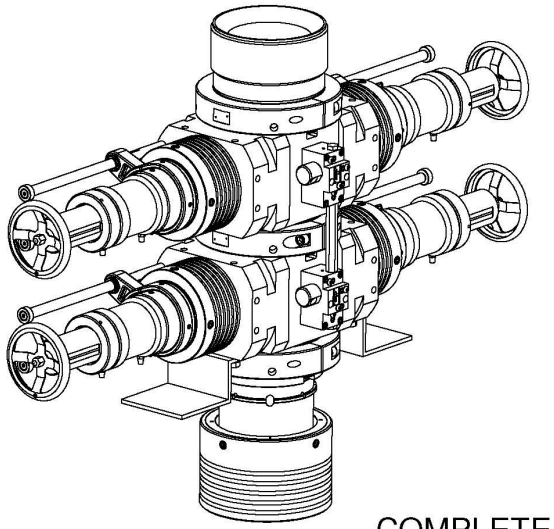


ASSEMBLY INSTRUCTIONS FOR MODULAR BODY SUB ASSEMBLY DWG No: ATP-3145




ASSEMBLY INSTRUCTIONS FOR 6 3/8" DUAL MODULAR BOP DWG No: ATP-3653



COMPLETE

ASSEMBLY INSTRUCTIONS FOR 6 3/8" DUAL MODULAR BOP DWG No: ATP-3653

## 5.7 Maintenance Record Sheet

| Date Performed | Type of Maintenance | Performed By | Verified By | Comments |
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**Table 2:Maintenance Record**

# 6 Testing

**All testing is to be carried out in the designated test area and by suitably qualified and competent personnel.**

**WARNING: Trapped air requires considerable time to compress and when it is compressed is highly dangerous. It has enough stored energy to separate parts with considerable force.**

## 6.1 Prepare BOP for pressure testing

- Check the pressure rating for all test equipment is sufficient to allow testing to be carried out.
- Check / replace o-ring on the pin part of the BOP.
- Ensure BOP is placed in an area suitable for pressure testing.
- Fit the BOP to the test stump.
- Makeup BOP (collar) on test stump by turning the "collar" all the way down, and then back off ¼ turn
- Fill BOP with test fluid.
- Connect the hydraulic hoses from the BCU to BOP to operate the rams.
- Check all connections / hoses that they are secured with safety wire before use
- Vent BOP Rams by hydraulic operation of the Rams.
- On completion of venting the Rams fit test cap, ensuring the valve is in the open position to allow air to vent and top up the BOP with Test Fluid. Once all air is expelled close valve.
- The BOP is now prepared for testing

## 6.2 Body Test

- Ensure that all the rams are in the open position
- Close equalizing valve 1A, all other equalizing valves to be open.
- Disconnect pipe on the grease injection and the chemical injection connector plate to test check valves.
- Fit the pressure test hose with security link
- Put up safety barrier in the workshop.
- Pump slowly up to 300 psi and observe for leaks. Hold Time 5 min
- Bleed the pressure to zero
- Pressurize to MWP of BOP and observe for leaks. Hold Time 15 min
- Bleed of pressure to zero and drain BOP.

## 6.3 Wireline Ram Seal Test (Between the ram)

- Ensure Test Cap is not fitted
- Ensure all Rams are in open position
- Open the equalizer valve between the respective rams to be tested.
- Connect the test hose in the 1A on equalizing block (gauge port)
- Close the Middle Ram.
- Open Snaptite connector on the test stump for verification of leakage on the lower ram.
- Fill the BOP with test fluid to above the Upper Ram. Close the Upper Ram by setting Ram to 2700 psi by activating the valves on the BCU to "close position.
- Pump test medium thru the equalizing. Block 1C to see fluid is rising above the upper ram.
- **Close equalizing valve 1C, 2A, 2D, 3A, 3B**.
- **Open equalizing valve : 1A, 1B, 1D**
- Put up safety barrier in the workshop.
- Pressure up to 300 psi in 5 minutes and observe for leaks
- Bleed off to zero
- Press up to MWP for bop according to documentation for current bop for 15 min
- Bleed pressure to zero.
- Open the rams- open lower first, and then the upper ram.

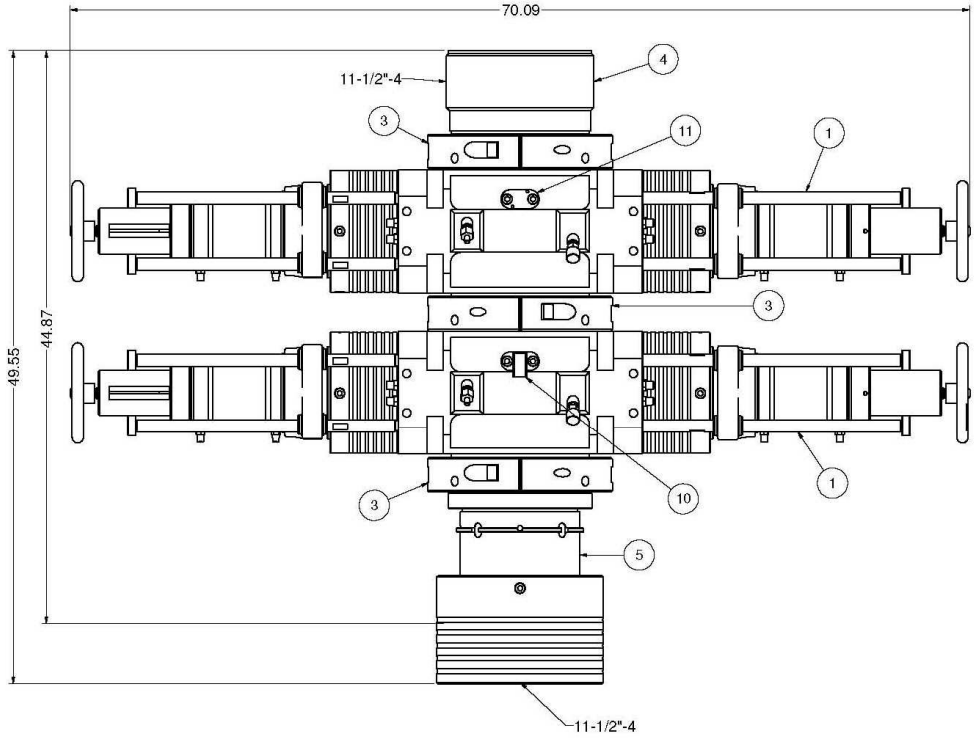
## 6.4 Post Test Procedure

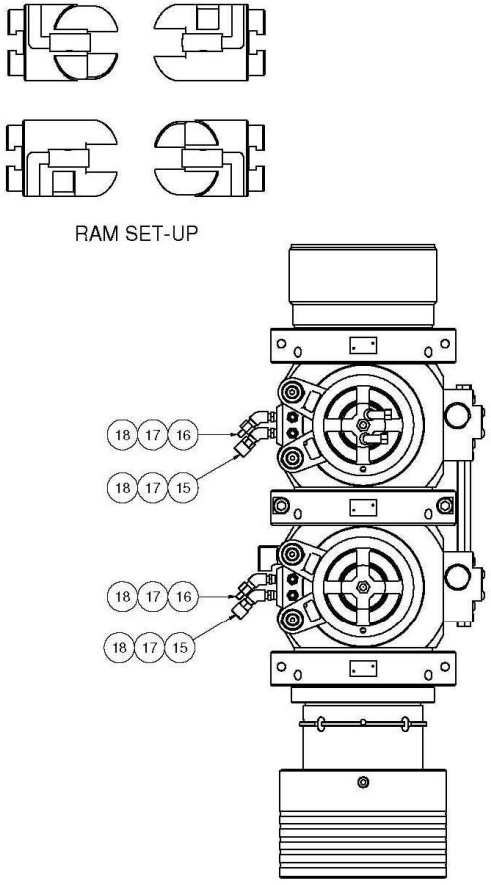
- Disconnect All Hoses
- Remove Test Cap
- Remove BOP from Test Stump
- Grease end connections and fit oiled thread protectors

# 7 Parts List and Drawings

| Item Number | Part Number | Quantity | Description |
|---|---|---|---|
| 1 | 196-3145-HV0 | 2 | 6-3/8 MULTILINE BODY ASSY |
| 3 | 196-3497-HS0 | 3 | CONNECTING COLLAR ASSY |
| 4 | 196-3151-HS0 | 1 | 11-1/2 QU TOP SUB ASSY |
| 5 | 196-3152-HV0 | 1 | 11-1/2 QU BOTTOM ASSY |
| 7 | 190-3997-480 | 1 | RIGHT ANGLED PORT 10K |
| 8 | 190-2821-316 | 2 | PORT BLANK END |
| 9 | 190-3998-HV0 | 1 | EQUALISING CHECK VALVE 10K |
| 10 | 190-3170-HV0 | 1 | SAVER  INJECTION ASSY |
| 11 | 190-3171-HV0 | 1 | BLANK SAVER ASSY |
| 13 | 190-3324-316 | 1 | EXTENSION BAR (12.625  P.C.D) |
| 14 | 801-0110-V80 | 5 | O-Ring - B.S Size 110 |
| 15 | 950-2558-316 | 2 | 1/4  SNAPTITE COUPLER (PT.NO. SVHC44FV) |
| 16 | 950-2559-316 | 2 | 1/4  SNAPTITE NIPPLE (PT.NO. SVHN44FV) |
| 17 | 950-3716-316 | 4 | 1/4" NPT 45 Degree Street Elbow |
| 18 | 950-3717-316 | 4 | 3/8" NPT x 1/4" NPT Connector |
| 100 | 910-3621-N66 | 1 | DW FEMALE PROTECTOR 11-1/2 |
| 101 | 910-3620-N66 | 1 | DW MALE PROTECTOR 11 1/2 |

**Table 3: 193-3568-HV0 Parts List**


70.09
11-1/2"-4
4
3
11
1
3
44.87
49.55
3
10
1
5
11-1/2"-4


RAM SET-UP
18 17 16
18 17 15
18 17 16
18 17 15

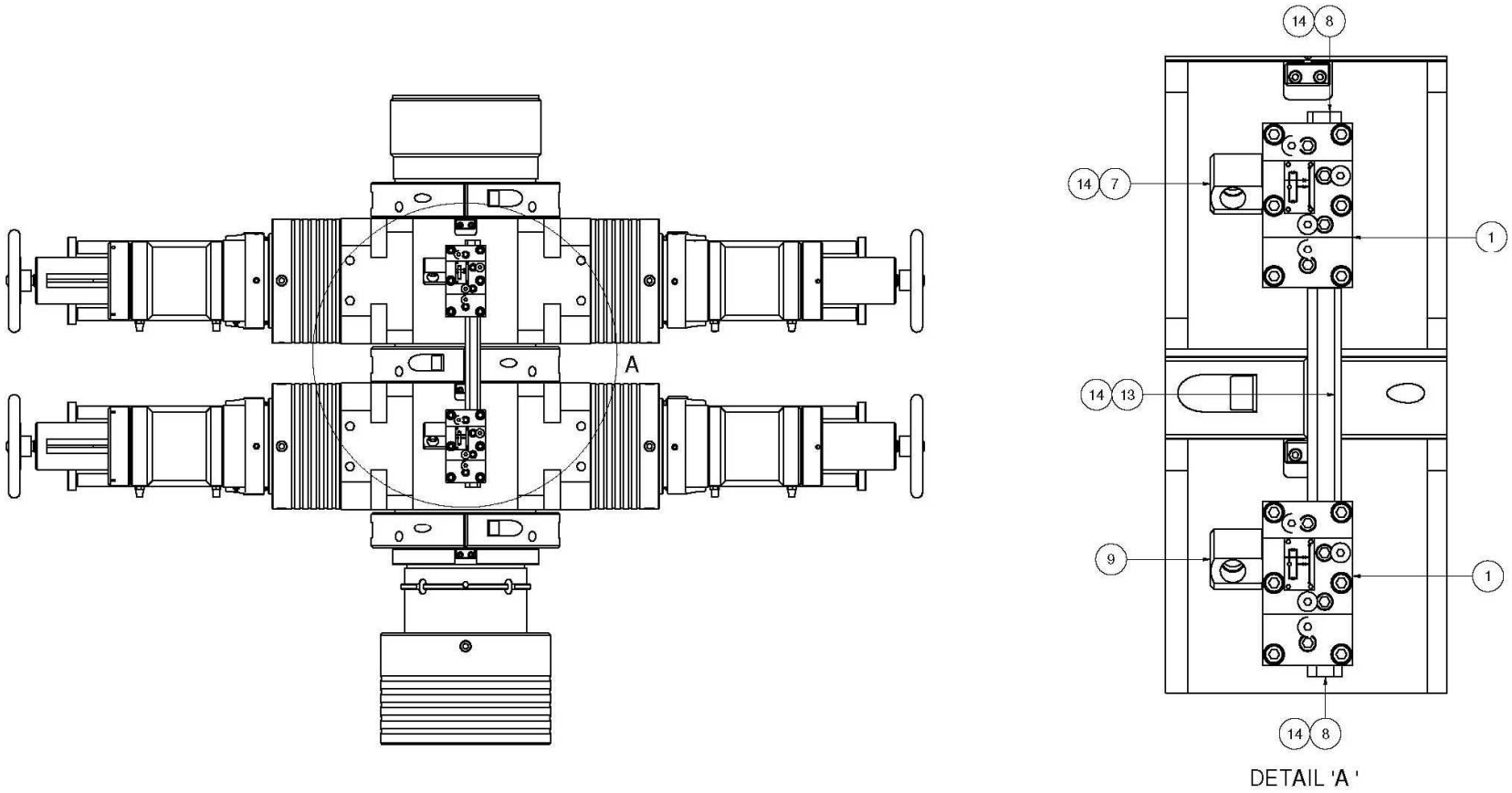



**Figure 5: Modular BOP 192-3653-HV0**

| Item Number | Part Number | Quantity | Description |
|---|---|---|---|
| 1 | 196-3318-480 | 1 | MODULAR BOP BODY - 10K |
| 2 | 190-2476-HV0 | 2 | ACTUATOR ASSEMBLY V2 |
| 3 | 190-3863-HH0 | 1 | 6 3/8 WIRELINE RAM ASSEMBLY V2 |
| 4 | 190-2806-HV0 | 1 | EQUALISATION BLOCK ASSEMBLY |
| 6 | 190-2413-X90 | 4 | SLIDER ROD 21.5  LONG |
| 8 | 190-1537-316 | 4 | END STOP |
| 10 | 802-2921-V80 | 1 | 7.642 T-SEAL WITH BACK-UPS |
| 11 | 196-2918-316 | 2 | BOP HOSE - OPEN |
| 12 | 196-2919-316 | 2 | BOP HOSE - CLOSE |
| 13 | 950-3168-316 | 4 | CONNECTOR 3/8 BSPP X 3/8 NPT (1252-06-06) |
| 14 | 950-3169-316 | 4 | CONNECTOR 1/4 BSPP X 1/4 NPT (1252-04-04) |
| 20 | CSU-0585-3A4 | 4 | CSink Soc Hd Size 1/2 Length 1 in |
| 21 | 196-3164-304 | 2 | DOWEL PIN 6MM X 32MM LONG |

**Table 4: Modular Body 196-3145-HV0**

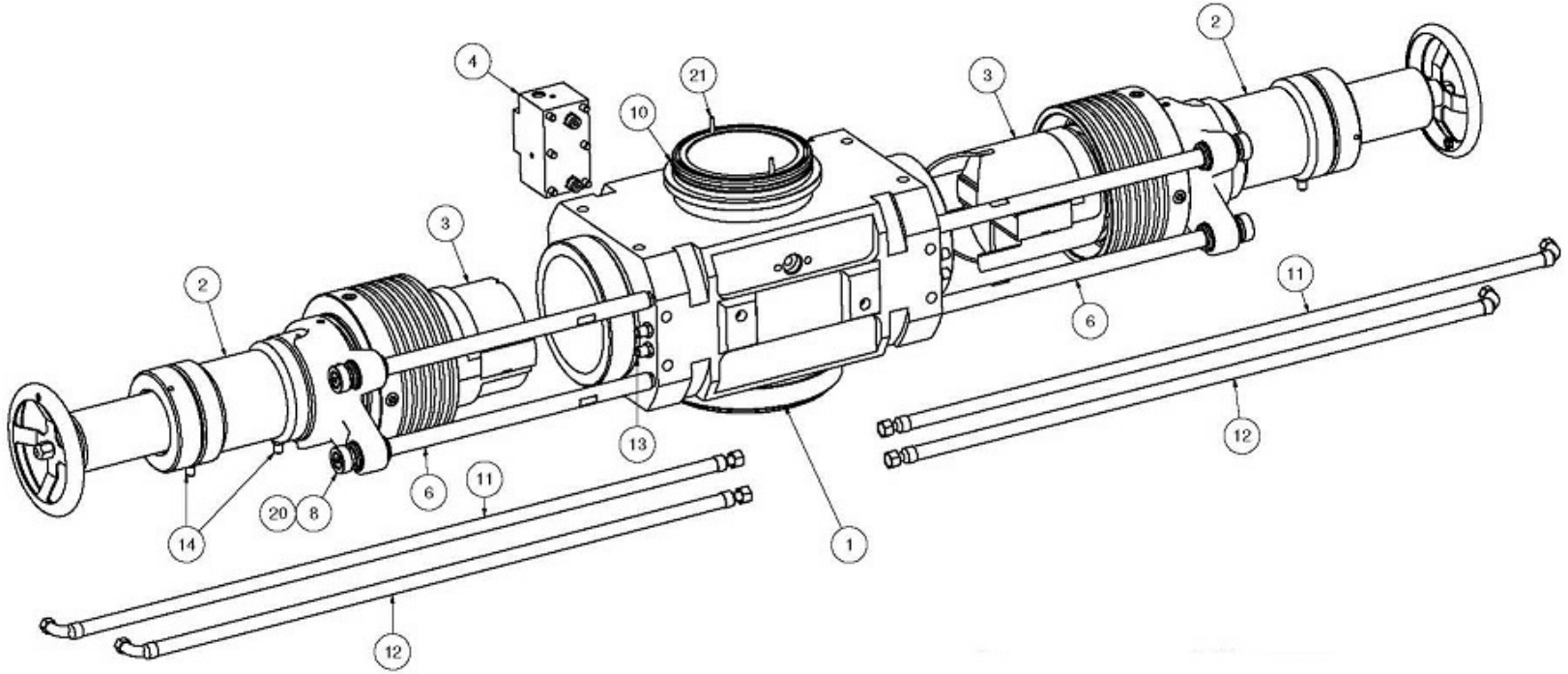



**Figure 6: Modular Body**

| Item | Part Number | Quantity | Description |
|---|---|---|---|
| 1 | 190-2927-480 | 1 | ROTATE CYLINDER CAP |
| 2 | 190-2772-480 | 1 | DRIVE ROD |
| 3 | 190-1726-480 | 1 | DRIVE SLEEVE |
| 4 | 190-1645-316 | 1 | INDICATOR ROD |
| 5 | 190-1649-480 | 1 | CAP COLLAR |
| 6 | 190-1773-STL | 1 | DRIVE KEY PLATE (CAST) |
| 7 | 190-2926-480 | 1 | HOUSING |
| 8 | 190-1929-480 | 1 | PISTON |
| 9 | 190-3233-STL | 1 | MODULAR ACTUATOR BRACKET |
| 10 | 190-1612-480 | 1 | Piston Seal Sub |
| 11 | 190-2863-480 | 1 | ACTUATOR COLLAR |
| 12 | 190-2838-480 | 1 | REWORKED RAM KEY PLATE |
| 13 | 190-1774-STL | 1 | RAM TEE |
| 20 | 190-1696-STL | 1 | Thrust Bearing (FAG 812 06) |
| 21 | 190-1702-STL | 1 | Hand Wheel |
| 22 | 190-1704-STL | 1 | Acorn Nut 1/2-13 |
| 23 | 190-1608-STL | 2 | Ball Slide ( TK-25-UU) |
| 30 | 802-1699-H85 | 1 | Rod T-Seal Assy (TR004) |
| 31 | 802-2505-H85 | 1 | ROD T-SEAL 0.825 DIA |
| 32 | 801-0345-V90 | 1 | O-Ring - B.S Size 345 |
| 33 | 802-2161-H85 | 1 | PISTON T-SEAL 4.000 |
| 34 | 801-0344-V90 | 1 | O-Ring - B.S Size 344 |
| 35 | 802-2162-H85 | 2 | ROD T-SEAL 1.625 |
| 36 | 801-0342-V90 | 1 | O-Ring - B.S Size 342 |
| 37 | 801-0439-V90 | 1 | O-Ring - B.S Size 439 |
| 40 | 190-2491-STL | 1 | EXTERNAL CIRCLIP (SH-75)- 0.750 DIA |
| 41 | 190-1756-STL | 4 | EXTERNAL CIRCLIP (EXT-0400) |
| 42 | SHC-0503-HTS | 4 | Soc Hd Cap Size 1/4 Length 0.5 in |
| 43 | SDU-0582-HTS | 3 | Set Screw Dog Point 1/2 UNC X 0.625 in |
| 44 | SHC-0581-HTS | 4 | Soc Hd Cap Size 1/2 Length 0.5 in |
| 45 | WNL-0580-316 | 5 | WASHER NORDLOCK (M12) |
| 46 | SDU-0503-HTS | 1 | Set Screw Dog Point Size 1/4 Length 0.5 in |
| 47 | 100-2179-STL | 1 | GREASE NIPPLE 1/8 NPT |

**Table 5: Actuator Assembly 190-2476-HV0**

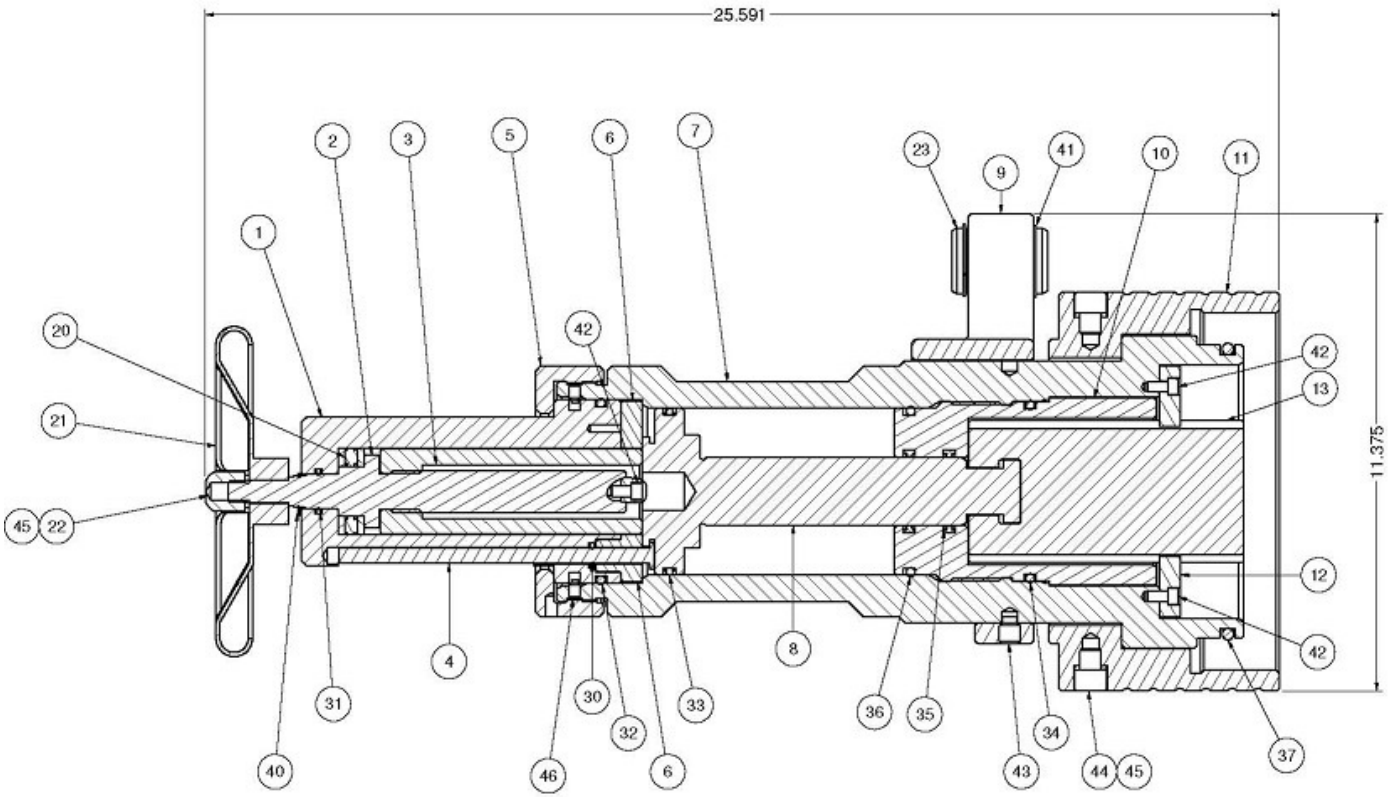



**Figure 7: 6 3/8 Actuator Part No 190-2476-HV0**

| Item | Part Number | Quantity | Description |
|---|---|---|---|
| 1 | 190-3705-480 | 1 | GUIDE RAM -6-3/8 |
| 2 | 190-3706-480 | 1 | SINGLE GUIDE RAM 6-3/8 |
| 3 | 190-1715-H70 | 2 | Outer Seal |
| 4 | 190-2998-H90 | 2 | RAM INNER SEAL - SIZE 7.00 |

**Table 6: Wireline Ram Assy 190-3863-HH0**

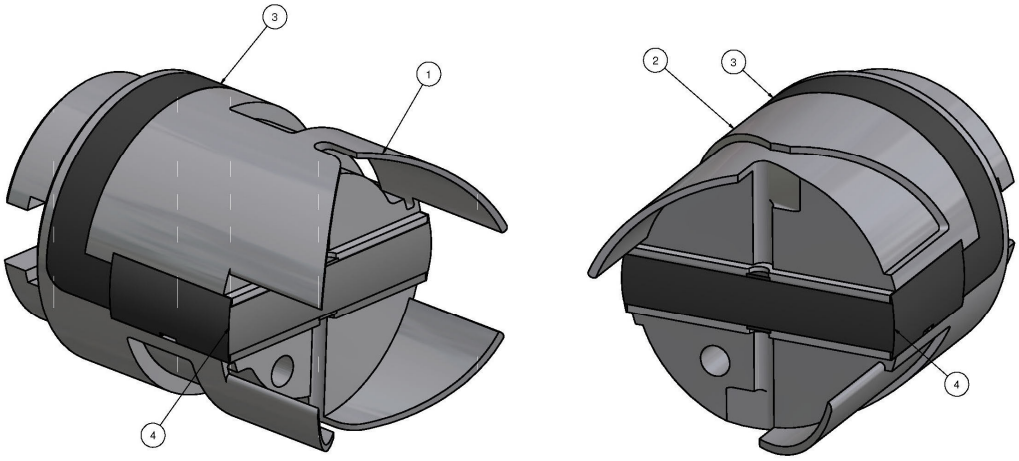



**Figure 8: Wireline Ram Assy 190-3863-HH0**

| Item | Part Number | Quantity | Description |
|---|---|---|---|
| 1 | 190-2813-480 | 1 | EQUALISATION BLOCK |
| 2 | 110-2979-316 | 4 | VALVE |
| 4 | 190-2823-PEK | 4 | VALVE SEAT |
| 10 | 190-1758-416 | 2 | AFO Plug (PLAA3124010A) |
| 11 | 801-0108-V90 | 4 | O-Ring - B.S Size 108 |
| 12 | 801-0110-V80 | 1 | O-Ring - B.S Size 110 |
| 13 | 801-0113-V90 | 2 | O-Ring - B.S Size 113 |
| 20 | SHC-0555-HTS | 6 | SOC HD SCREW 3/8 UNC X 3.0 LONG |
| 21 | SBC-0543-304 | 4 | Button Hd Screw Size 3/8 Length 0.625 in |
| 22 | WNL-0540-304 | 10 | Nord Lock Washer Size 3/8 |
| 23 | 190-3328-316 | 1 | VALVE PLATE (EQUALISATION BLOCK) |

**Table 7: Equalisation Assy**

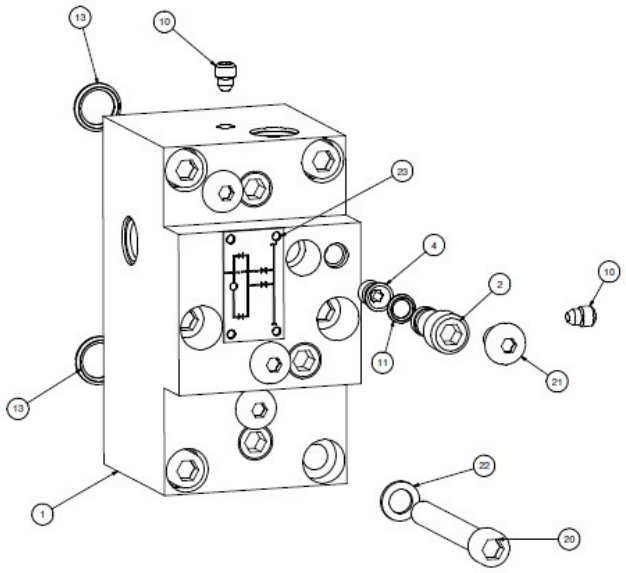



**Figure 9: Equalisation Assy**

| Item Number | Part Number | Quantity | Description |
|---|---|---|---|
| 1 | 196-3496-411 | 1 | BOLTED COLLAR |
| 2 | SHC-0673-AL7 | 2 | Soc Hd Cap 3/4-UNC x 3.5" Long |
| 3 | WNL-0660-316 | 2 | WASHER NORDLOCK (M12) |
| 4 | 190-2791-316 | 1 | LOCK BLOCK |
| 5 | SHC-0507-HTS | 2 | Soc Hd Cap Size 1/4 Length 1 in |
| 6 | 190-2804-304 | 1 | SPIROL ROLL PIN 1/4" DIA X 1" |

**Table 8: Bolted Collar Parts List 196-3497-HS0**

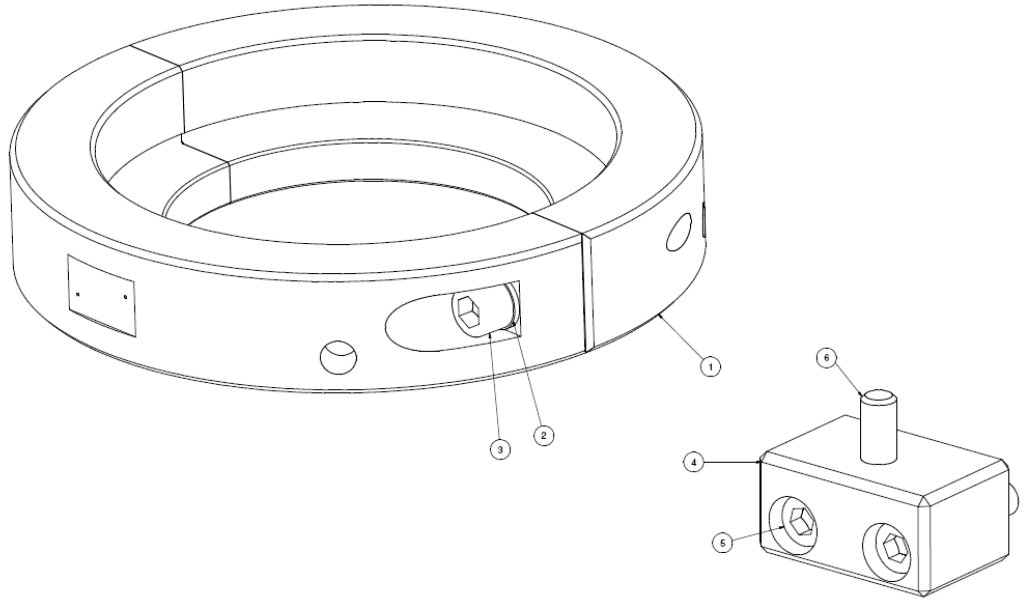
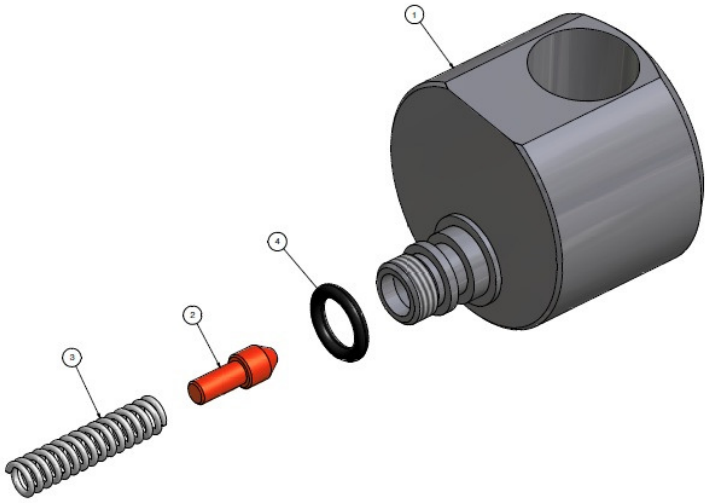



**Figure 10: Bolted Collar Assembly 196-3497-HS0**

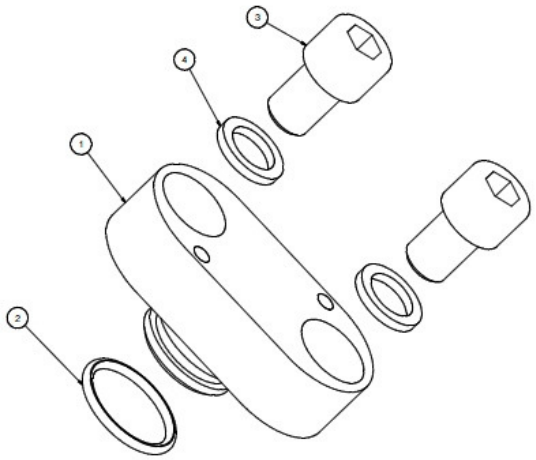
| Item | Part Number | Quantity | Description |
|---|---|---|---|
| 1 | 190-3997-480 | 1 | RIGHT ANGLED PORT 10K |
| 2 | 100-2114-PEK | 1 | CHECK VALVE SEAL |
| 3 | 145-2185-STL | 1 | COMP SPRING (D22120) |
| 4 | 801-0110-V80 | 1 | O-Ring - B.S Size 110 |
| 100 | 910-2186-N66 | 1 | 1/2in SHIPPING CAP PLUG |

**Table 9: 190-3159-HV0**



| Item | Part Number | Quantity | Description |
|---|---|---|---|
| 1 | 205-2105-480 | 1 | BLANK TEST PORT |
| 5 | 801-0119-V90 | 1 | O-Ring - B.S Size 119 |
| 10 | SHC-0583-3A4 | 2 | Soc Hd Cap Size 1/2 Length 0.75 in |
| 11 | WNL-0580-304 | 2 | WASHER NORDLOCK (M12) |

**Table 10: 190-3171-HV0**



# 8 Spares

Use only spares supplied or approved by Phuel Oil Tools Ltd.

It is recommended that sufficient quantities of the following spares be maintained to ensure that the equipment is always available when required.

Elastomeric spares are supplied in Viton material as standard. Other materials are available please specify when ordering.

| Part Number | Quantity | Description | Comment |
|---|---|---|---|
| RDK-2476-HV0 | 4 | Actuator Redress Kit | |
| RDK-2806-HV0 | 2 | Equalisation/Isolation Redress Kit | |
| 801-0110-V80 | 8 | O-Ring BS 110 | |
| 801-0119-V90 | 2 | O-Ring BS 119 | |
| 801-0443-V90 | 1 | O-Ring BS 443 | Bottom Sub |
| 802-2921-V80 | 3 | 7.642 T-SEAL WITH BACK-UPS | |

**Table 11: BOP Redress Kit RDK-3653-HV0**

| Part Number | Quantity | Description | Comment |
|---|---|---|---|
| 801-0345-V90 | 1 | O-Ring - B.S Size 345 | |
| 801-0342-V90 | 1 | O-Ring - B.S Size 342 | |
| 801-0344-V90 | 1 | O-Ring - B.S Size 344 | |
| 801-0439-V90 | 1 | O-Ring - B.S Size 439 | |
| 802-2505-H85 | 1 | ROD T-SEAL 0.825 DIA | |
| 802-2162-H85 | 2 | ROD T-SEAL 1.625 | |
| 802-2161-H85 | 1 | PISTON T-SEAL 4.000 | |
| 802-1699-H85 | 1 | Rod T-seal Assy (TR004) | |

**Table 12: Actuator Redress Kit RDK-2476-HH0**

| Part Number | Quantity | Description | Comment |
|---|---|---|---|
| 190-1715-H70 | 4 | Outer Seal – 6 3/8" | |
| 190-2998-H90 | 4 | Inner Seal – 6 3/8" | 6.5 K only |
| 190-3689-H90 | 4 | Inner Seal – 6 3/8" | 10K only |

**Table 13: Wireline Ram Redress Kit RDK-3863-HH0**

| Part Number | Quantity | Description | Comment |
|---|---|---|---|
| 801-0108-V90 | 4 | O-Ring BS 108 | |
| 801-0110-V80 | 2 | O-Ring BS 110 | |
| 801-0113-V90 | 2 | O-Ring BS 113 | |

**Table 14: Equalisation/Isolation Redress Kit RDK-2806-HV0**

Individual seals and parts may be ordered as required. See the parts list in the previous section for part numbers